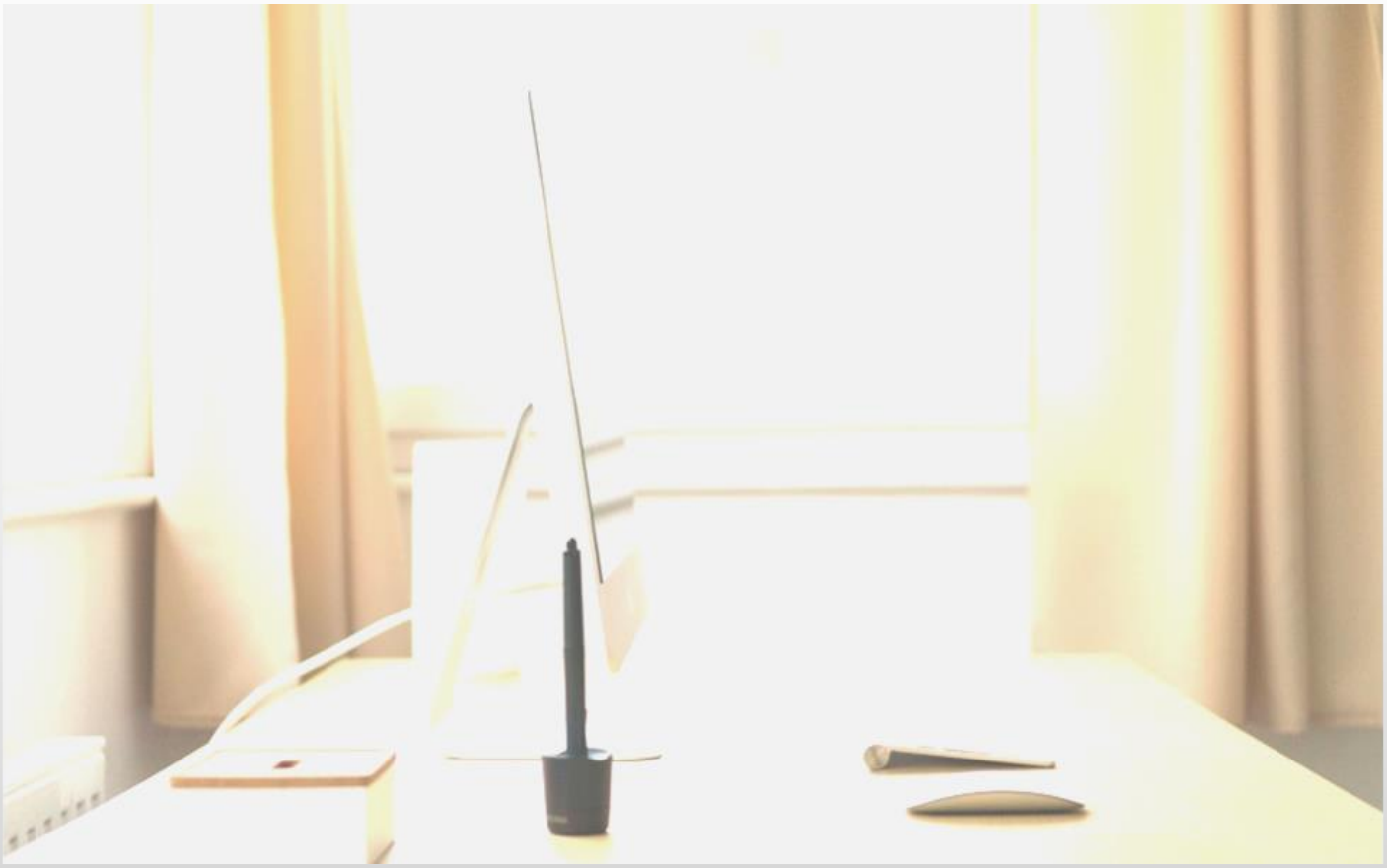
Invention Analysis Report



Button Cell with Electrode - Separator Assembly in the form of Spiral Winding

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1. OBJECTIVE OF SEARCH

Objective behind this search report is to check the novelty of the proposed invention, by uncovering closely related prior art and references in the technology space. Further, this report lists down other alternate technological solutions that are available in the public domain. Hence, the report is divided in 4 sections:

Section A ***Patentability Search Report***

- This section of the report helps in understanding the patentability of proposed invention.

Section B ***State of the Art***

- This section of the report gives a brief overview of similar patented technology / research work.

Section C ***Alternate Technology***

- This section of the report helps in understanding alternate technological solutions that are proposed by competitors to solve similar types of drawback in existing technology .

Section D ***Technology Landscape***

- This section of the report gives a ariel view on technology landscape summarizing top players in the market, patenting trend in the technology space.

Section E ***Market Analysis***

- This section helps in understanding the value of proposed invention from market point of view.

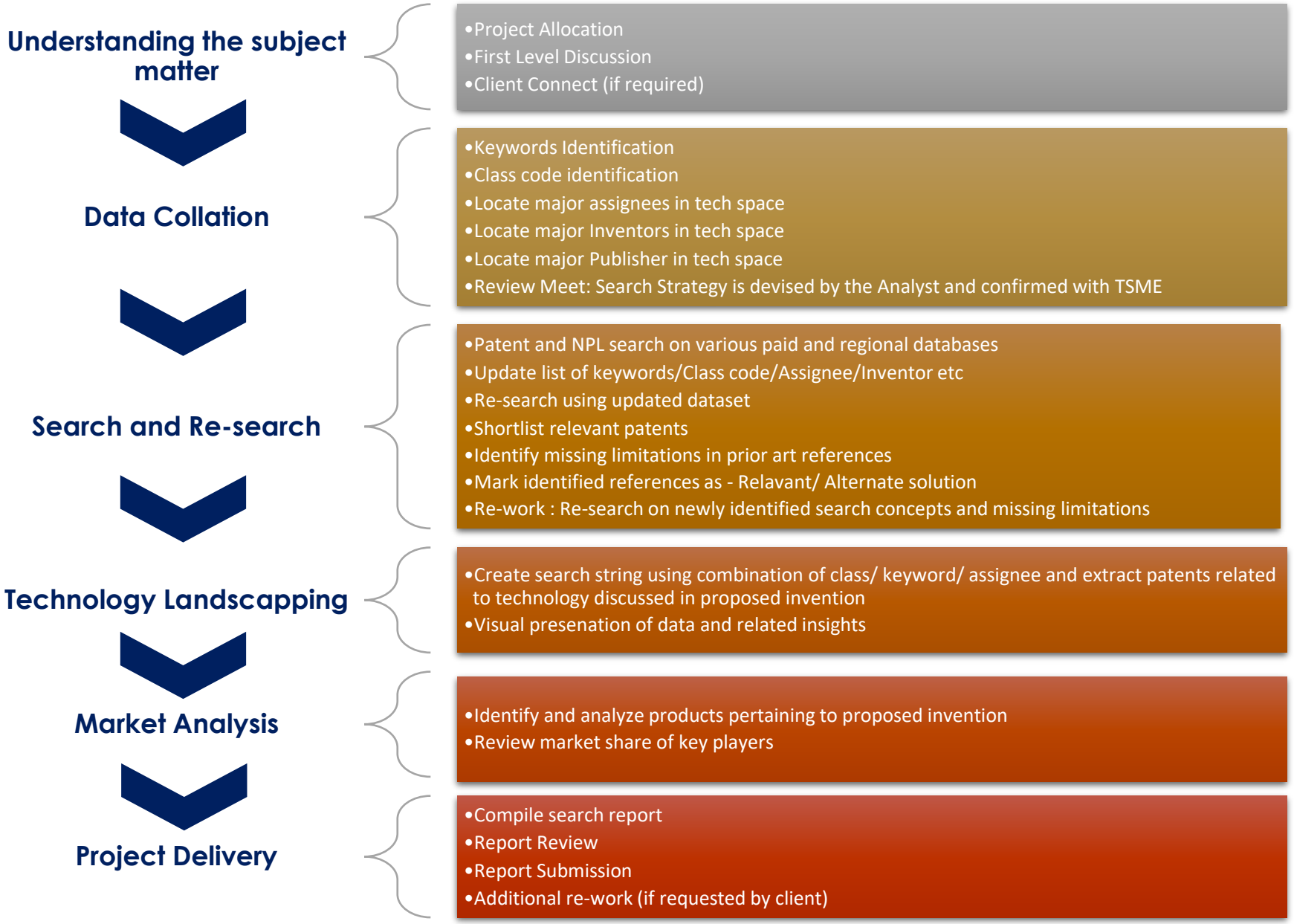
2. UNDERSTANDING THE SUBJECT MATTER

The proposed invention relates to button cells comprising of a top and bottom metallic housing part separated and sealed using an electrically insulating seal. An electrode-separator assembly contains at least one positive and one negative electrode. An electrode-separator assembly is formed by placing an insulator as a separator in between flat positive and negative electrodes in the form of a spiral winding.

The electrode-separator assembly is aligned in a perpendicular manner to the surface of the button cell and is thereafter dropped into a metallic hosing part (button cell). The same is then sealed using an adhesive sealant. The end portion of one electrode is connected to top of the metallic housing part and the end portion of the other electrode is connected to the bottom housing part.

The orthogonal alignment of the electrode layer results in considerable improvement of the sealing characteristics of the button cell. The improvement is due to the fact that the volume of electrodes of lithium-ion cells continuously change during the charging and discharging processes. That due to the orthogonal arrangement, the mechanical forces which are created during this process, no longer act on the primary axis as said force is transmitted on the radial axis. The radial forces are absorbed much better than axial forces by the housing of a button cell.

3. SEARCH METHODOLOGY



Section A: Patentability Search

Upon completion of the prior art search three potentially relevant patents were found.

4. MAPPING SCORECARD

Key Features	Result 1	Result 2	Result 3
Button cell comprising top and bottom metallic housing parts	✓	✓	✓
An electrode-separator assembly comprising an insulator placed as separator in between flat positive and negative electrodes	✓	✓	✓
The electrode- separator is in the form of a spiral winding	✓	✓	✓
The electrode-separator assembly is aligned perpendicular to the surface of button cell	✓	✓	✓
The electrode-separator assembly is packed in the metallic hosing parts (button cell) and is sealed using adhesive sealant	✓	✓	✓
End portion of one electrode is connected to top metallic housing part	✓	✓	✓
End portion of second electrode is connected to bottom metallic housing part	✓	X	X

5. DETAILED ANALYSIS OF PRIOR ART REFERENCES

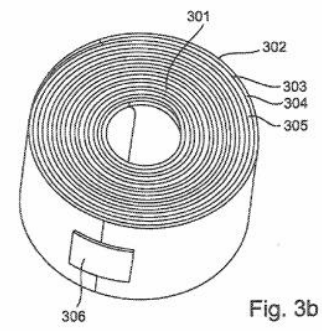
RESULT -1 BACK

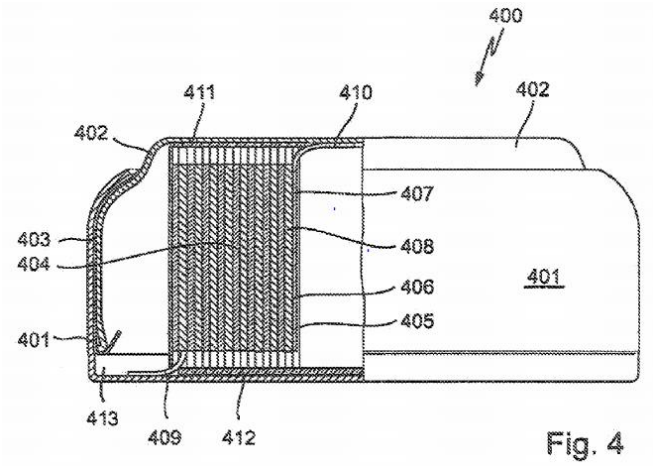
Publication Number:	US20120015224A1		
Title:	Button cells and method for producing same		
Priority Date:	2009-02-09	**Publication Date**	2012-01-19
Inventor(s):	Eduard Pytlik | Jürgen Lindner | Ulrich Barenthin | Winfried Gaugler		
Assignee(s)/ Applicant(s):	VartaMicrobattery GmbH		

ABSTRACT

A button cell includes a housing cup and a housing top separated from one another by an electrically insulating seal and which form a housing with a flat bottom area and a flat top area parallel to it and an electrode-separator assembly within the housing including at least one positive and at least one negative electrode in the form of flat layers and connected to one another by at least one flat separator, wherein the electrode layers are aligned essentially at right angles to the flat bottom and top areas and the button cell is closed without being beaded over.

Key Features	Prior Art (US20120015224A1)

Button cell comprising top and bottom metallic housing parts	**[Para 16]** Our button cell comprises two metallic housing half-parts separated from one another by an electrically insulating seal and form a housing with a flat bottom area and a flat top area parallel to it.
An electrode-separator assembly comprising an insulator placed as separator in between flat positive and negative electrodes	**[Para 31]** Particularly preferably, the assembly comprising electrodes and a separator in our button cell has one of the following layer sequences: negative electrode/separator/positive electrode/separator or positive electrode/separator/negative electrode/separator.
The electrode- separator is in the form of a spiral winding	In both cases, this shows that the assembly comprises two layers; separators 302 and 303 as well as two electrode layers 304 and 305 (a positive and a negative electrode). The assembly is wound up in a spiral shape and is held together by an adhesive tape 306 on its outside.  Fig. 3b

The electrode-separator is aligned perpendicular to the surface of button cell	**[Abstract]** A button cell includes a housing cup and a housing top separated from one another by an electrically insulating seal and which form a housing with a flat bottom area and a flat top area parallel to it and an electrode-separator assembly within the housing including at least one positive and at least one negative electrode in the form of flat layers and connected to one another by at least one flat separator, wherein the electrode layers are aligned essentially at right angles to the flat bottom and top areas and the button cell is closed without being beaded over.  Fig. 4
The electrode-separator assembly is packed in the metallic hosing parts (button cell) and is sealed using adhesive sealant	**[Para 58]** One important aspect in this case is the choice of the seal which connects the cell cup to the cell top. The seal is preferably a plastic seal which connects the cell cup to the cell top. The seal is preferably a plastic seal composed of a thermoplastic.

End portion of one electrode is connected to top metallic housing part	**[Para 26]** Preferably, the electrode winding is a spiral electrode winding, the axial cavity which has been mentioned in the center of the winding is preferably essentially cylindrical (in particular circular-cylindrical). On the casing side, it is bounded by the winding, and at the end it is bounded by corresponding surfaces of the bottom area and of the top area of the button cell housing.
End portion of second electrode is connected to bottom metallic housing part	**[Para 26]** Preferably, the electrode winding is a spiral electrode winding, the axial cavity which has been mentioned in the center of the winding is preferably essentially cylindrical (in particular circular-cylindrical). On the casing side, it is bounded by the winding, and at the end it is bounded by corresponding surfaces of the bottom area and of the top area of the button cell housing.

Searcher's Summary

The prior art discloses a novel feature in the design of the button cell. Invention disclosed in the prior art involves a metallic housing cup top separated from each other by an electrical insulating seal. The electrode layers are then aligned essentially at right angles to the flat bottom and top areas and the button cell is closed without being beaded over.

RESULT -2

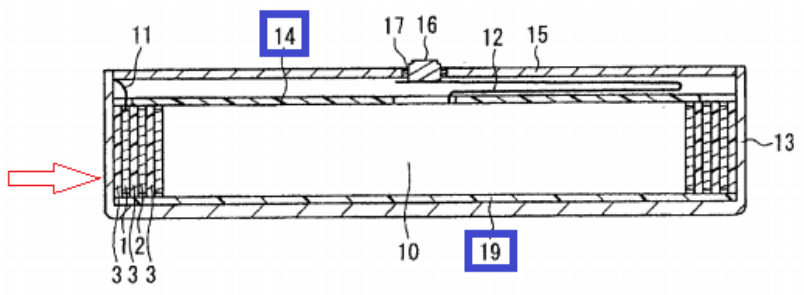
BACK

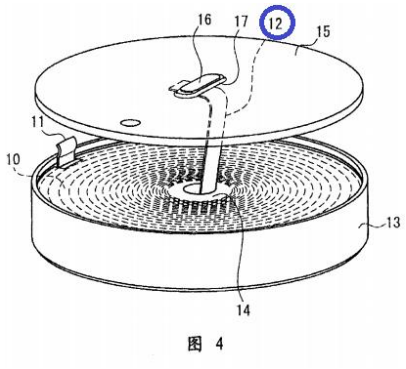
Publication Number:	CN101286572A		
Title:	Nummular non-aqueous electrolyte secondary battery		
Priority Date:	2007-04-12	**Publication Date**	2008-10-15
Inventor(s):	Hayato Higuchi | Kenichi Sano | Kazuyuki Nakazaki		
Assignee(s)/ Applicant(s):	Hayato Higuchi | Kenichi Sano | Kazuyuki Nakazaki		

ABSTRACT

The invention provides a coin-shaped non-water electrolyte secondary battery, having a high characteristic of discharge load without distorted battery when charging and discharging. The invention is characterized in that a strip anode (1) and a strip cathode (2) are winded to form a cylindraceous winder (10) by regarding a strip clapboard (3) as middle medium. Winding shaft of the winder (10) shares a same direction with height of a battery cylinder (13). The ratio D/H of outer diameter D (mm) of the winder (10) and height H (mm) at direction of the winding shaft is 1 to 25. The ratio R/A of area A (mm2) of upper surface of the winder (10) and reaction valid area R (mm2) relative to the anode (1) and the cathode (2) is 9 to 25.

Key Features | **Prior Art (CN101286572A)**

Button cell comprising top and bottom metallic housing parts	**[Page 1]** The present invention relates to a high discharge load characteristic of a coin-shaped non-aqueous electrolyte secondary battery. **[Page 8]** 5A is a state of the battery can 13 and the lid 15 of the laser (Laser) engaged in a perspective view. FIG. 5B is a sectional view taken along line BB of FIG. 5A. 5B, the contents of the sealed container is formed by the cover 15 and the battery can 13 is accommodated wound body 10, the bottom of the battery can 13 is disposed lower insulating plate 19.
An electrode-separator assembly comprising an insulator placed as separator in between flat positive and negative electrodes	**[Page 8]** As described above, the strip wound body 10 has a strip-shaped separator 3 interposed between the positive electrode 1 and the strip negative electrode 2, a spiral wound configuration.
The electrode- separator is in the form of a spiral winding	**[Page 8]** As described above, the strip wound body 10 has a strip-shaped separator 3 interposed between the positive electrode 1 and the strip negative electrode 2, a spiral wound configuration.
The electrode-separator assembly is aligned perpendicular to the surface of button cell	**[Page 8]** FIG 2 is a perspective view of the insert 10 in the step 13 of a cylindrical wound body of the battery can. Wound body 10 is inserted into the battery can 13, so that the winding axis N coincides with the height direction of the battery can 13 M. 

The electrode-separator assembly is packed in the metallic hosing parts (button cell) and is sealed using adhesive sealant	**[Page 8]** 5A is a state of the battery can 13 and the lid 15 of the laser (Laser) engaged in a perspective view. FIG. 5B is a sectional view taken along line BB of FIG. 5A. 5B, the contents of the sealed container is formed by the cover 15 and the battery can 13 is accommodated wound body 10, the bottom of the battery can 13 is disposed lower insulating plate 19.
End portion of one electrode is connected to top metallic housing part	Symbol Description: Wound body 10, 11 positive lead,12 negative lead  图 4
End portion of second electrode is connected to bottom metallic housing part	***Searcher's Comment:*** *Unlike the proposed invention, both positive and negative leads are connected to the upper surface (top) of the battery can.*

Searcher's Summary

The prior art discloses a button cell in which a strip wound body is arranged perpendicular to the top and bottom surfaces. The strip wound body comprises a strip-shaped separator interposed between the positive electrode and the strip negative electrode.

However, unlike the proposed invention, both top and bottom electrodes are connected to the upper housing of the button cell.

RESULT -3

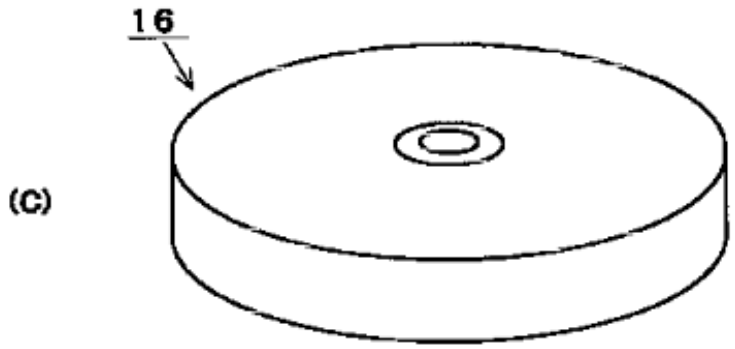
BACK

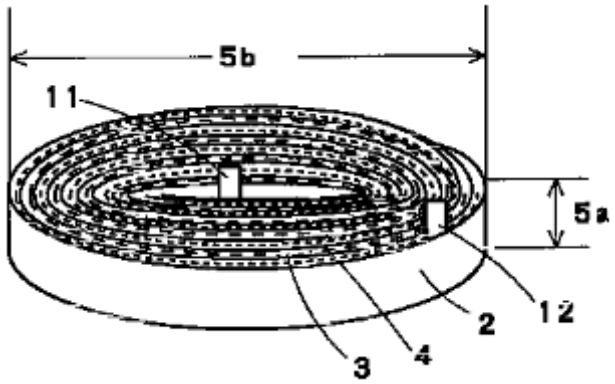
Publication Number:	JPH11345626A		
Title:	Sealed Battery		
Priority Date:	1998-06-01	**Publication Date**	1999-12-14
Inventor(s):	Shirasu Tetsuo		
Assignee(s)/ Applicant(s):	NEC Mori Energy		

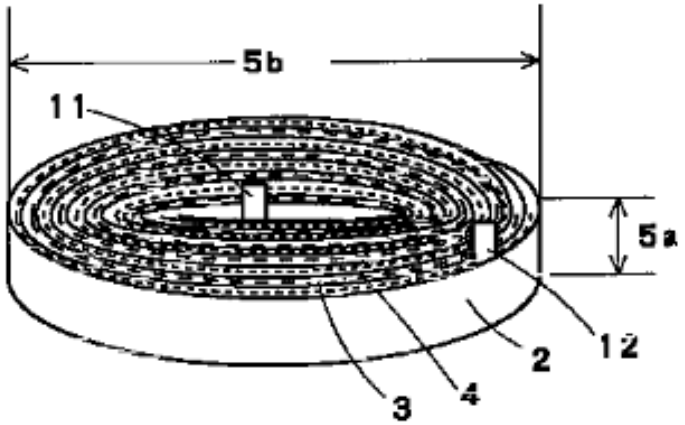
ABSTRACT

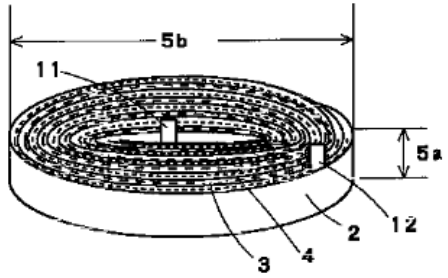
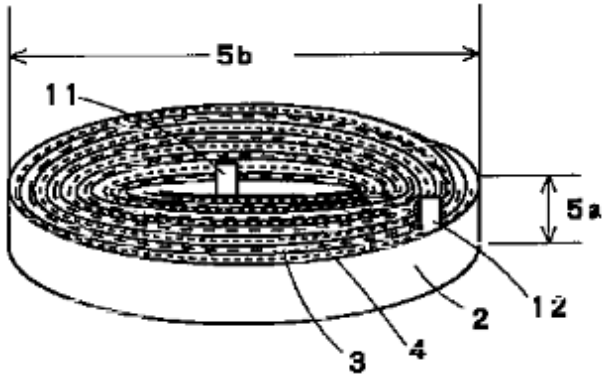
PROBLEM TO BE SOLVED: To densely wind to increase capacity density per volume and make size small by winding a positive electrode plate and a negative electrode plate through a separator, making the diameter larger than the height in the winding axis direction, and forming in a flat shape.

SOLUTION: A positive electrode plate and a negative electrode plate 4 each formed by applying an active material to a current collector are cylindrically wound through a separator 2 to produce a power generating element jellyroll 5. The jellyroll 5 is formed in a flat cylindrical shape whose height 5a is smaller than the diameter 5b. The jellyroll 5 can densely be wound without concentrating the pressure on a part, capacity density per volume can be increased, expansion in charging is made in the vertical direction to the axis, the surface 15 in the vertical direction resists expansion pressure, and use of thin material is made possible. The jellyroll 5 is housed in a flat container of a square pillar type 13 or a cylindrical type 16 to form a battery, the battery is made easy to handle, and effectively utilized even in small electronic equipment.

Key Features	Prior Art (JPH11345626A)
Button cell comprising top and bottom metallic housing parts	**[Para 16]** FIG. 1 (C) shows a flat cylindrical battery 16 in which the flat jelly roll shown in FIG. 1 (A) is housed in a cylindrical container.  (C)

An electrode-separator assembly comprising an insulator placed as separator in between flat positive and negative electrodes	**[Para 3]** The cylindrical battery 1 includes a power generation element in which a positive electrode plate 3 in which a positive electrode active material is applied to a positive electrode current collector and a negative electrode plate 4 in which a negative electrode active material is applied to a negative electrode current collector is wound with a separator 2 interposed therebetween. A jelly roll 5 is prepared and accommodated in a battery can 6 and sealed with an electrode header 7 from above after injecting an electrolytic solution.
The electrode- separator is in the form of a spiral winding	**[Para 3]** The cylindrical battery 1 includes a power generation element in which a positive electrode plate 3 in which a positive electrode active material is applied to a positive electrode current collector and a negative electrode plate 4 in which a negative electrode active material is applied to a negative electrode current collector is wound with a separator 2 interposed therebetween. A **jelly roll 5** is prepared and accommodated in a battery can 6 and sealed with an electrode header 7 from above after injecting an electrolytic solution. 

The electrode-separator assembly is aligned perpendicular to the surface of button cell	**[Para 14]** The jelly roll 5 of the battery of the present invention comprises a positive electrode plate 3 in which a positive electrode active material is applied to a positive electrode side current collector and a negative electrode plate 4 in which a negative electrode side current collector is applied with a negative electrode active material, with a separator 2 interposed therebetween. It is wound in a cylindrical shape, has a flat cylindrical shape in which the height 5a of the jelly roll 5 is smaller than the diameter 5b, and has a positive electrode conductive tab 11 and a negative electrode conductive tab 12. 
The electrode-separator assembly is packed in the metallic hosing parts (button cell) and is sealed using adhesive sealant	**[Para 13]** BEST MODE FOR CARRYING OUT THE INVENTION The present invention relates to a sealed battery in which a power generation element is wound, and a flat jelly roll in which the diameter of a jelly roll having a power generation element wound in a cylindrical shape is larger than the height of the jelly roll.

End portion of one electrode is connected to top metallic housing part	**[Para 15]** It is wound in a cylindrical shape, has a flat cylindrical shape in which the height 5a of the jelly roll 5 is smaller than the diameter 5b, and has a positive electrode conductive tab 11 and a negative electrode conductive tab 12. 
End portion of second electrode is connected to bottom metallic housing part	**[Para 15]** It is wound in a cylindrical shape, has a flat cylindrical shape in which the height 5a of the jelly roll 5 is smaller than the diameter 5b, **and has a positive electrode conductive tab 11 and a negative electrode conductive tab 12.**  ***Searcher's Comment:*** *Unlike the proposed invention, both ends of the jelly roll is connected to the upper housing part.*

Searcher's Summary

The prior art discloses a button cell in which a spiral wound body is arranged perpendicular to the top and bottom surfaces. The spiral body comprises a strip-shaped separator interposed between the positive electrode and the strip negative electrode.

However, unlike the proposed invention, both top and bottom electrodes are connected to the upper housing of the button cell.

Section B: State of the Art

1. PATENT LITERATURE

S No	Patent Number	Title	Assignee	Publication Date
1	US7468222B2	Electrochemical device	TDK	2005-07-07
2	US20110091753A1	Rechargeable lithium ion button cell battery	Ditto	2011-04-21
3	WO2013106821A1	Lithium coin cell construction to mitigate damage from ingestion	Weiwei Huang	2013-07-18
4	WO2013185972A1	Electrochemical energy storage cell and method for producing an electrochemical energy storage cell	Armin Glock	2013-12-19

2. NON-PATENT LITERATURE

S No	Title	Author/ Publisher	Publication Date
1	Batteries: fifty years of materials development	Solid State Ionics Volume 134, Issues 1–2, 1 October 2000, Pages 139-158	2000
2	Emphasis on LFP/LTO Li-Ion technology: From thematerial, composite electrode design to full cellbehavior in several designs including bipolartechnology	S. Jouanneau et al Depart. of Electricity and Hydrogen for Transportation Laboratory of Advanced Batteries (LBA)France	2010

Section C: Alternate Technological Solutions

Upon completion of the search, we came across 2 prior art references that claim to solve the same problem with a different approach

RESULT -1 BACK

Publication Number:	US7566515B2		
Title:	Electrochemical device		
Priority Date:	1999-08-27	**Publication Date**	2005-12-08
Inventor(s):	Masami Suzuki		
Assignee(s)/ Applicant(s):	Maxell		

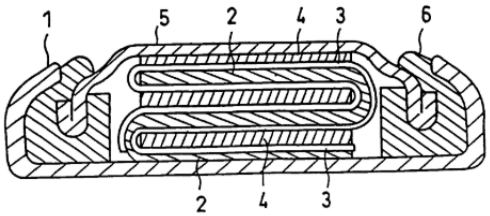
Abstract

A non-aqueous electrolyte secondary cell containing an electricity-generating element with at least a cathode, a separator and an anode and a non-aqueous electrolyte inside a cathode case, electrode units each consisting of the cathode and the anode opposite to each another via the separator laminated to form an electrode group, or an electrode unit in a sheet form consisting of the cathode and the anode opposite

to each another via the separator wound to form an electrode group, or a sheet-shape cathode wrapped with the separator except for a part contacting at inner face of cathode case and a sheet-shaped anode set on the sheet-shaped cathode in a right angled position each other and bent alternately to form an electrode group, and the total sum of the areas of the opposing cathode and anode in the electrode group larger than the area of the opening of an insulating gasket in a sealed portion in the cathode case or than the area of an opening in a sealed plate in a sealed portion in the cathode case.

Relevant Text from the Prior Art

Then, **the cathode active material-containing layer formed on the single-coated cathode plate was arranged to face the double-coated anode plate via separator 3 consisting of a polyethylene fine-porous membrane of 25 µm in thickness, such that the electrically connecting portion in the anode was positioned in the opposite side to the electrically connecting portion in the cathode plate.** Then, the double-coated cathode plate was installed such that its electrically connecting portion was directed in the same direction as the previously arranged cathode plate, followed by arranging another single-sided anode plate opposite the double-coated cathode plate via separator 3 such that the anode active material-containing layer 4 b on the single-coated anode plate was brought into contact with the separator, while the electrically connecting portion in the single-coated anode plate was directed in the same direction as the electrically connecting portion in the previously arranged anode plate.



Searcher's Comment

The prior art discloses a button cell wherein an insulator is placed between positive and negative electrodes.

However, unlike the proposed invention, electrode separator assembly is placed parallel to the top and bottom surfaces which might lead to early wearing and tearing of container during prolonged discharging.

RESULT -2

BACK

Publication Number:	US6521373B1		
Title:	Flat non-aqueous electrolyte secondary cell		
Priority Date:	1999-08-27	**Publication Date**	2003-02-18
Inventor(s):	Masami Suzuki et al		
Assignee(s)/ Applicant(s):	Maxell Holdings		

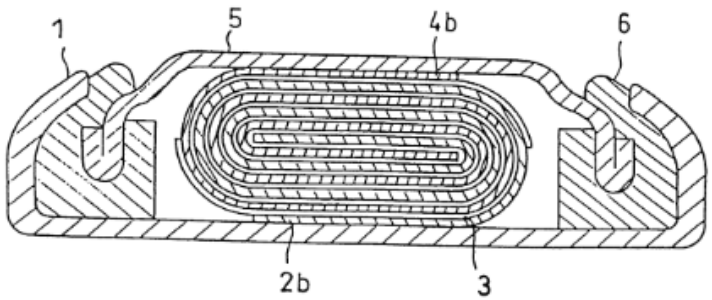
Abstract

In a flat non-aqueous electrolyte secondary cell comprising an electricity-generating element including at least **a cathode, a separator and an anode and a non-aqueous electrolyte in the inside of a cathode case,** a plurality of electrode units each consisting of the cathode and the anode opposite to each another via the separator are laminated to form an electrode group, **or an electrode unit in a sheet form consisting of the cathode and the anode opposite to each another via the separator is wound to form an electrode group, or a sheet-shape cathode is wrapped with the separator except for a part contacting at inner face of cathode case and a sheet-shaped anode is set on the sheet-shaped cathode in a right angled position each other and then these cathode and anode are bent alternately to form an electrode group, and the total sum of the areas of the opposing cathode and anode in this electrode group is larger than the area of the opening of an**

insulating gasket in a sealed portion in the cathode case or than the area of an opening in a sealed plate in a sealed portion in the cathode case, whereby the discharge capacity upon heavy-loading discharge is significantly increased as compared with the conventional cells. Accordingly, while the size of the cell is small, the discharge capacity is increased as described above, and thus it is possible to provide a highly utilizable flat non-aqueous electrolyte secondary cell. Further, in said flat non-aqueous electrolyte secondary cell, problems which may be caused by the increased discharge capacity in the cell can be solved by improving the solvent and supporting electrolyte for the electrolyte or by various improvements in the cathode and anode cases.

Relevant Text from the Prior Art

Accordingly, the present inventors have solved this problem from a different viewpoint from the prior art by laminating electrode units each consisting of **a cathode, an anode and a separator, or by winding an electrode unit, or by bending alternately the sheet-shaped cathode and the sheet-shaped anode settled in a right angled position each other,** in a cell case for the very small coin- or button-shaped flat cell, to permit the total sum of the areas of the opposing cathode(s) and anode(s) in the electrode group to be larger than the area of the opening of the insulating gasket.



Searcher's Comment

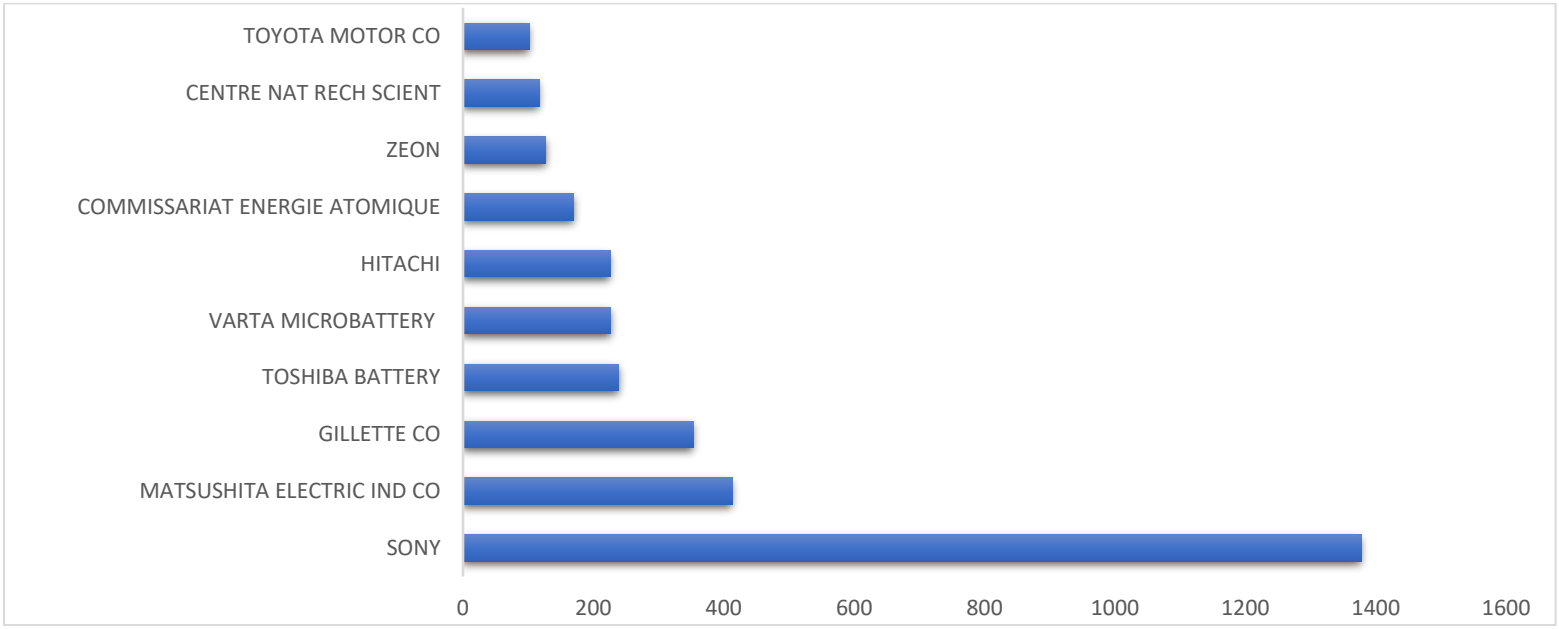
The prior art discloses a button cell wherein an insulator is placed between positive and negative electrodes. The positive-negative electrode and interposed separator assembly is in the form of spiral winding and is arranged inside the cell container.

However, unlike the proposed invention, the spiral winding is placed in the way such that the positive and negative electrode lie parallel to the top and bottom surfaces.

Section D: Technology Overview

3. MAJOR INVESTORS IN THE TECHNOLOGY SPACE

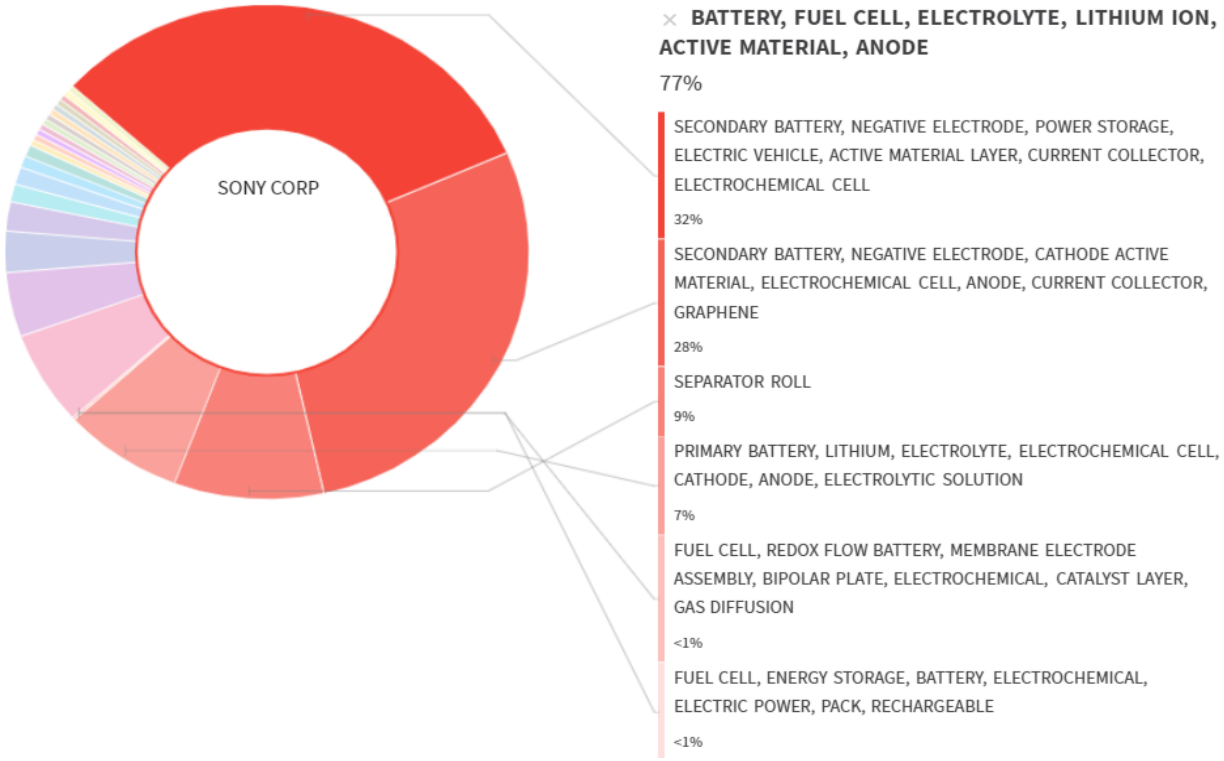
A quick analysis of the patents, in the technology space reveals that Sony holds the greatest number of patents relating to battery, more specifically technology, related to electrodes, its compositions and arrangement inside container. In the battery domain, most of the key patent holders, belong to Japan. The analysis reveal that the research work is mainly carried out in Japan. As a result, more than 40% patent/ priority applications are filed in Japan and are then subsequently taken to Chinese, American and European patent offices. Among specialized organizations, VartaMicrobattery, Germany holds many key patents relating to button cell.



4. TECHNOLOGY DISTRIBUTION OF TOP PLAYERS IN THE TECHNOLOGY SPACE

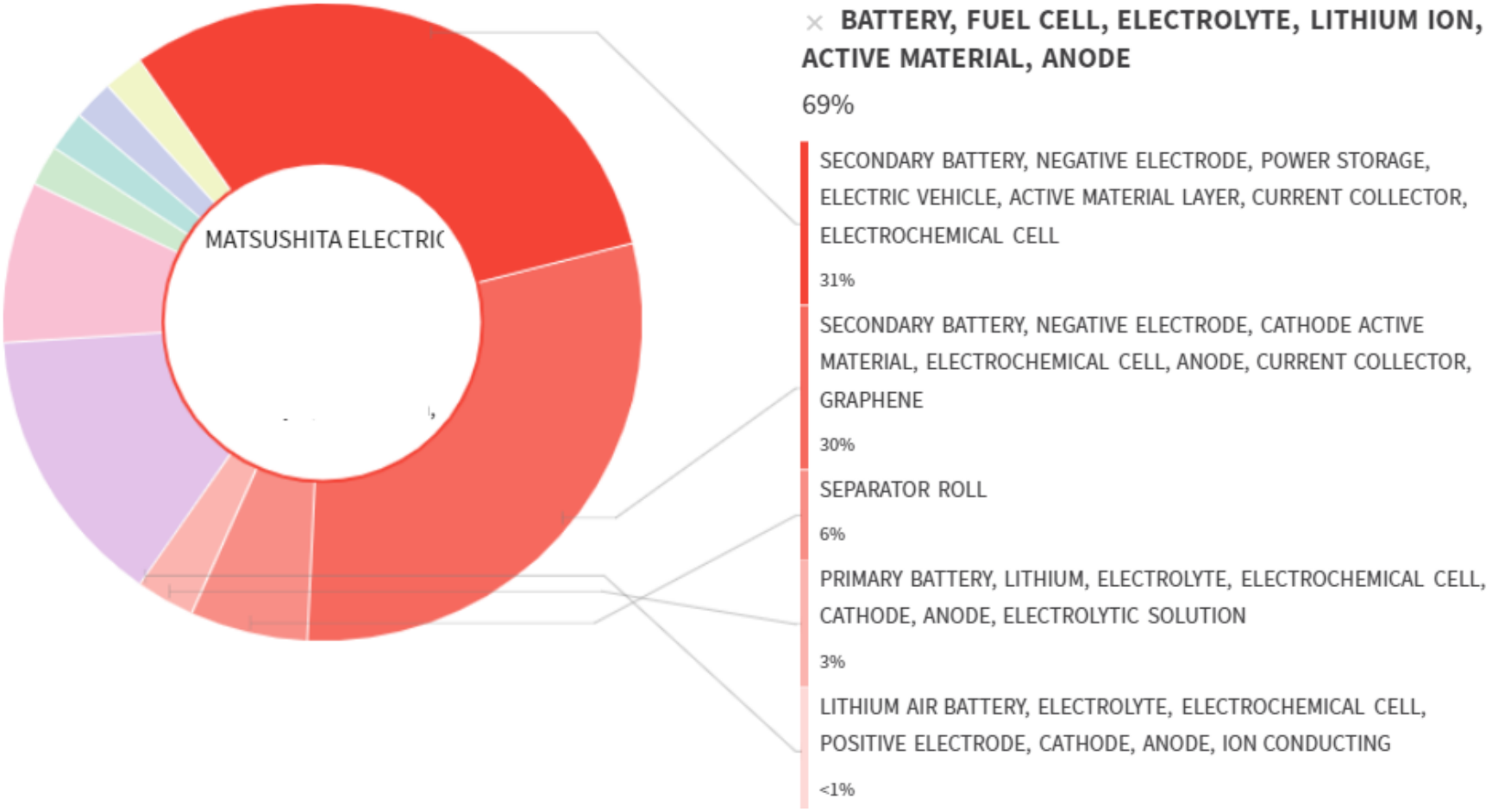
SONY

Sony is the frontrunner in the tech space with almost 300% more patents in the technology space than its closest competitor Matsushita. Through its large patent portfolio, Sony covers all major technology domains that relate to battery and its construction. However, a detailed study suggests that in recent years, Sony is primarily focusing on electrode materials and their research work is primarily aimed at enhancing efficiency and life of batteries.



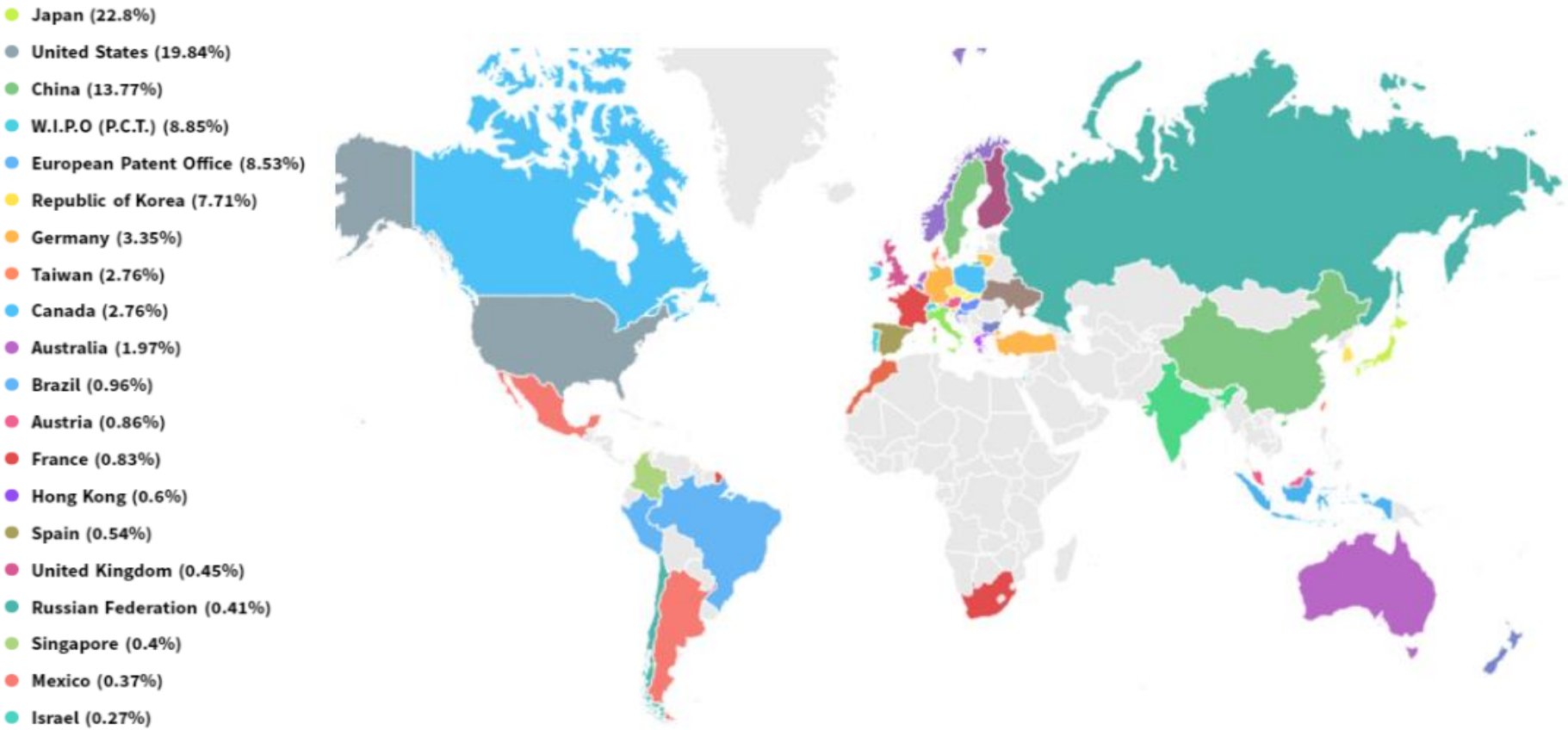
MATSUSHITA

Amongst other corporations, Matsushita is the leading one that is actively investing in button cells. Most of their research and patenting activity is centered around physical properties of battery.



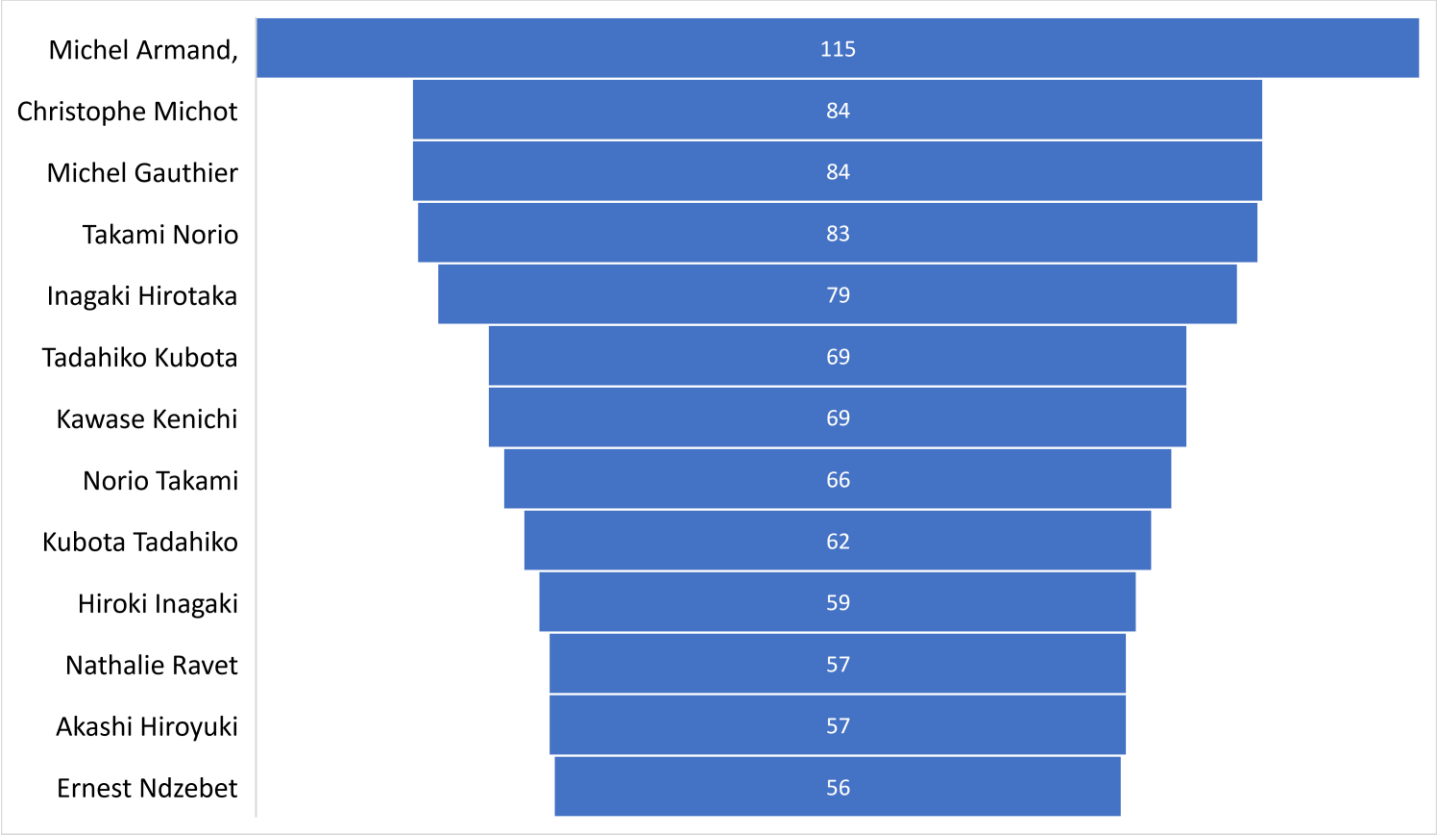
5. COUNTRIES THAT ARE ACTIVELY DEVELOPING THE TECHNOLOGY

Japan is the home ground for key players in the technology space, around 40% of patents originate in Japan and are subsequently filed in the big markets like USA, China, Europe, and other Asian countries. Data reflects that out of approximately 11000 patents in the domain, 23% patent applications were filed in Japanese patent office alone followed by USA and China. Most of the research labs of these key players are in Japan and China.



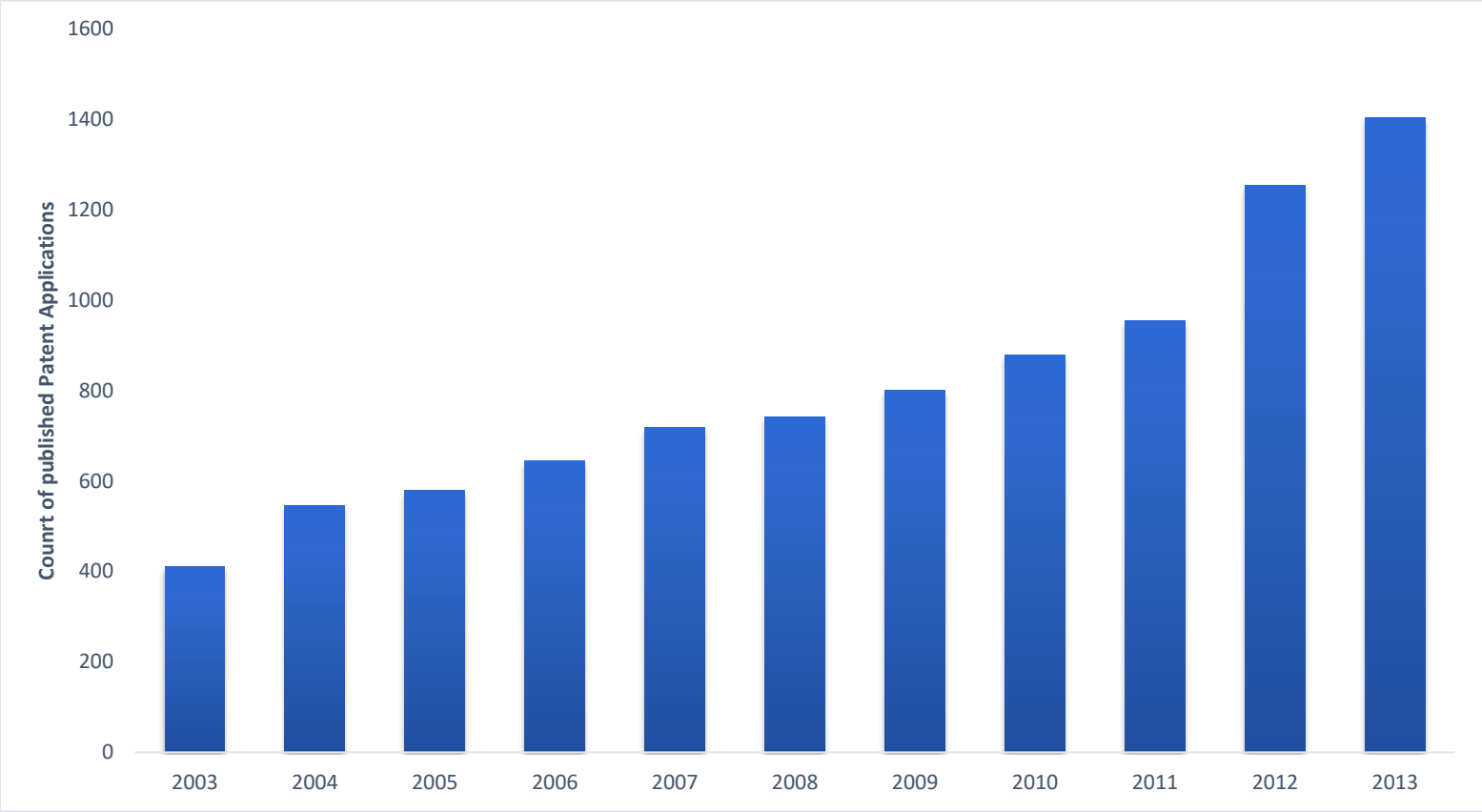
6. TOP RESEARCHERS /INVENTORS WORKING IN THE DOMAIN

The research work is highly concentrated in Japanese Labs owned by Japanese organizations. Hence, it is obvious that top innovators and researchers belong to Japan. They are associated with the R&D departments of some of the leading battery manufacturers in the region. Below is a list of top 25 patent holders in the said technology space.



7. PUBLICATION TREND OF PATENTS IN THE TECHNOLOGY SPACE

Trend of patent applications published in last 10 year shows a gradual rise in patenting activity in the domain. After introduction of portable/ handheld electronic devices for athletes, medical practitioner etc., lots of newcomers along with big corporates are now investing fairly in the domain, with an aim to position themselves in the upcoming market of portable smart devices.



Section E: Market Analysis

1. COMPATIBLE PRODUCTS

At present, Maxell and Renata are the two biggest manufacturer and supplier of button cells in the market followed by Eveready, Panasonic Toshiba, Seiko. Below is a concise list of bestseller products pertaining to proposed button cell technology.

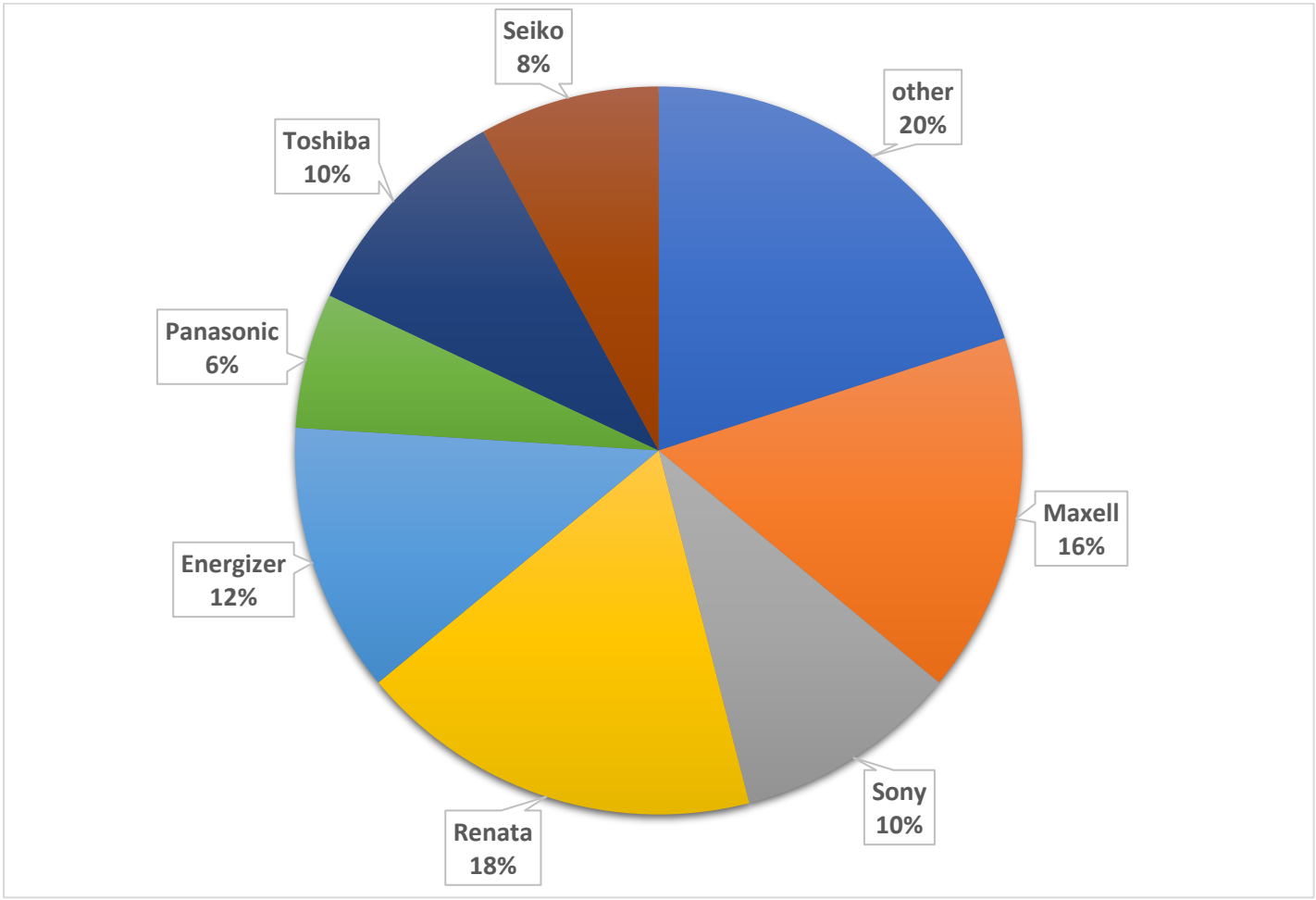
S No	Company	Model		About Product
1	Maxell (Hitachi)	LR41 AG3 192		Maxell LR41 provide superior resistance against leakage and thus prevents cells from deteriorating prior or during use. This battery utilizes an alkaline chemistry with a 1.5V voltage and is primary (non-rechargeable). The 6-8-year shelf life is great for buying in bulk and stocking up on replacement cells, ensuring your batteries stay fresh and ready-to-use years down the line.1.5V Alkaline button cell. It weighs 22.7 gms and product dimension is 0.4 x 0.8 x 0.4 cm

2	Renata	SR731SW		Renata SR731SW 329 is swiss made Silver Oxide Button 1.55V Battery. It weighs 0.96 ounces and product dimension is 0.4 x 0.4 x 0.4 inches
3	Sony	Sony 377 SR626SW		Sony 377 (SR626SW) is 1.55V Silver Oxide 0% Hg i.e., a series of Mercury Free Watch Battery from Sony. It weighs 22.7 gms and product dimension is 15.5 x 15.2 x 0.5 cm
4	Eveready	Energizer 397/396 (SR726SW, SR726W) Silver Oxide Watch Battery		The Energizer 397/396 is a silver oxide cell whose power is undeniable. The perks of a silver oxide cell outweigh those of an alkaline button battery, as the Energizer 397/396 has a stable output voltage that lasts throughout the course of its service life, making it the perfect battery for low drain continuous use devices. This button cell also has a low self-discharge, so it will last for a long time. It weighs 0.018oz and product dimension is 0.311" (L) x 0.311" (W) x 0.102" (H)

5	Varta	CR2032		The Varta VCR2032 Electronic Lithium 3V Battery is both a reliable and long-lasting power source that you can count on to fuel your devices. The advantage of lithium batteries lie in their high energy density, high cell voltage and longer shelf life due to low self-discharge. Use Varta batteries to deliver the right energy for almost every need and for almost every device. It weighs 3 gms.

2. MARKET SHARE

Below graph shows the market share of key buttoned cell manufacturer in FY 2012-2013



3. SWOT ANALYSIS

Based on the study of the domain vis-à-vis the disclosed subject matter, the following SWOT matrix was arrived at. It features the Strength, Weakness, Opportunities and Threats associated with the technology disclosed in the proposed invention.

Strength	Weakness
-Durability: As the Electrode separator roll is aligned perpendicular to the container, it reduces the stress on the body of container during discharging, thus reducing wear and tear of the container. This eventually results in the increase of battery life. **-Cost advantage and ease of manufacturing:** Use of roll instead of parallel sheets results in quick and easy manufacturing of battery.	**-Additional Machinery:** Use of a wounded electrode separator pair requires additional setting up of machinery units. It increases the cost to manufacturing. **-Shelf Life:** Since roll is not attached to the container, it deforms during transportation. It eventually results in lower shelf, and transport life thereby adversely affecting overseas sales.
Opportunity	**Threat**
-Trending Technology: The proposed technology belongs to an active field of research, where many research organizations and companies are filling patents thereby investing time, money etc. to make button cell more efficient and long lasting. **-Growing Market:** Growing interest of big corporates like Apple, Google, Philips, Fitbit etc. will surely give boost to market of button cell market in upcoming days. **-Licensing: With an increase in** active technology licensing collaboration between research institutes and companies in this field, more growth is anticipated.	**-Alternate Technologies:** Lot of alternate technologies are available for technology buyers and implementors. **-IP sensitivity and enforcement:** Patent enforcement might be a major threat considering number of earlier existing technologies around folded electrode and its modifications to improve efficiency.

APPENDIX

4. DATABASES USED

The search was conducted in the following databases:

Patent Databases	Derwent Innovation | Orbit | Google Patents | Espacenet | WIPO | JPO | FREE PATENT ONLINE | DEPATISNET | CIPO | SIPO
Non-Patent Databases	Google | IEEE | SCIENCE DIRECT | CiteSeerX

5. KEYWORDS

One or more of the key words listed below have been used in different combinations while conducting the prior art search

Keywords	Technical Synonyms
Button Cell	Flat cell | Battery | Accumulator | Coin | Watch cell
Housing	Case | Cover | Encapsulation | Capsule | Package | Body | Container | Enclosure | Jacket | Holder | Shell
Electrode	Conductor | Anode | Cathode | Terminal | Plate
Separator	Insulator | Non-conductive | Divider | Partition | Isolator |
Spiral	Folded | Coil |Helix | Curl | Corkscrew | Twist | Scroll | Wind | Swirl
Alignment	Placement | Arrangement | Positioned | Orgnanised

Perpendicular	Angle | 90 | Right Angle | Upright | Vertical | Erect
Adhesive	Stick | Glue | Gummed | Glue | Fixative | Bond | Binder | Resin | Epoxy | Sealant | Seal

6. SEARCHCONCEPTS

Following search concepts/strategies were identified and were used to search on different databases using combination of class/keyword/active assignee/inventors in the domain.

	Derwent Innovation
1	ALL=(((Button OR flat) NEAR2 (cell OR battery OR accumulator)) AND (Electrode OR Conductor OR Anode OR Cathode OR Terminal OR Plate) AND (Separator OR Insulator OR Non-conductive OR Divider OR Partition OR Isolator) AND (Spiral OR Folded OR Coil OR Helix OR Curl OR Corkscrew OR Twist OR Scroll OR Wind OR Swirl) AND (Align* OR Place* OR Arrang* OR Position* OR Organi*) AND (Perpendicular OR Angle OR "Right Angle" OR Upright OR Vertical OR Erect) AND (Adhesive OR Stick OR Glue OR Gummed OR Glue OR Fixative OR Bond OR Binder OR Resin OR Epoxy OR Sealant OR Seal)) ;
2	AIC=((H01M000202) OR (H01M00020222) OR (H01M00020207) OR (H01M00020227) OR (H01M00020225) OR (H01M00020202) OR (H01M00020287) OR (H01M000610) OR (H01M001004) OR (H01M00100427) OR (H01M00100422) OR (H01M00100431) OR (H01M00100409) OR (H01M0010045) OR (H01M00100463)) ;

3	ALL=(((Button OR flat) NEAR2 (cell OR battery OR accumulator)) AND (Electrode OR Conductor OR Anode OR Cathode OR Terminal OR Plate) AND (Separator OR Insulator OR Non-conductive OR Divider OR Partition OR Isolator) AND (Spiral OR Folded OR Coil OR Helix OR Curl OR Corkscrew OR Twist OR Scroll OR Wind OR Swirl) AND (Align* OR Place* OR Arrang* OR Position* OR Organi*) AND (Perpendicular OR Angle OR “Right Angle” OR Upright OR Vertical OR Erect) AND (Adhesive OR Stick OR Glue OR Gummed OR Glue OR Fixative OR Bond OR Binder OR Resin OR Epoxy OR Sealant OR Seal)) OR AIC=((H01M2/02) OR (H01M2/0222) OR (H01M2/0207) OR (H01M2/0227) OR (H01M2/0225) OR (H01M2/0202) OR (H01M2/0287) OR (H01M6/10) OR (H01M10/04) OR (H01M10/0427) OR (H01M10/0422) OR (H01M10/0431) OR (H01M10/0409) OR (H01M10/045) OR (H01M10/0463)) ;
4	ALL=((Electrode OR Conductor OR Anode OR Cathode OR Terminal OR Plate) AND ((Align* OR Place* OR Arrang* OR Position* OR Organi*) NEAR8 (Perpendicular OR Angle OR "Right Angle" OR Upright OR Vertical OR Erect))) AND AIC=((H01M000202) OR (H01M00020222) OR (H01M00020207) OR (H01M00020227) OR (H01M00020225) OR (H01M00020202) OR (H01M00020287) OR (H01M000610) OR (H01M001004) OR (H01M00100427) OR (H01M00100422) OR (H01M00100431) OR (H01M00100409) OR (H01M0010045) OR (H01M00100463)) ;
5	ALL=((Electrode OR Conductor OR Anode OR Cathode OR Terminal OR Plate) AND ((Separator OR Insulator OR Non-conductive OR Divider OR Partition OR Isolator) NEAR6 (Spiral OR Fold* OR Coil* OR Heli* OR Curl* OR Corkscrew OR Twist* OR Scroll OR Wind* OR Swirl))) AND AIC=((H01M000202) OR (H01M00020222) OR (H01M00020207) OR (H01M00020227) OR (H01M00020225) OR (H01M00020202) OR (H01M00020287) OR (H01M000610) OR (H01M001004) OR (H01M00100427) OR (H01M00100422) OR (H01M00100431) OR (H01M00100409) OR (H01M0010045) OR (H01M00100463)) ;

6	AIC=((H01M00100427 OR H01M00020222) AND (H01M00100431 OR H01M00100409 OR H01M0010045 OR H01M00100463)) AND ALL=((electrode OR Conductor OR Anode OR Cathode OR Terminal OR Plate) NEAR5 (perpendicular OR Angle* OR "Right Angle" OR Upright OR Vertical OR Erect));
7	AIC=((H01M00100427 OR H01M00020222)) AND ALL=((electrode OR Conductor OR Anode OR Cathode OR Terminal OR Plate) NEAR5 (perpendicular OR Angle* OR "Right Angle" OR Upright OR Vertical OR Erect));
8	AIC=(H01M00100427) AND ALL=((electrode OR Conductor OR Anode OR Cathode OR Terminal OR Plate) NEAR5 (perpendicular OR Angle* OR "Right Angle" OR Upright OR Vertical OR Erect));
9	AIC=(H01M00100427) AND CTB=(electrode);
10	AIC=(H01M00100427 OR H01M00020222) ;
5	**Espacenet**
1	(Button OR coin) AND (H01M2 OR H01M10)
2	Electrode AND (wound OR spiral OR coil) AND (H01M2 OR H01M10)
3	(Force OR stress) electrode (H01M2 OR H01M10)
4	(Perpendicular OR orthogonal OR “right angle” OR parallel) AND electrode AND (H01M2 OR H01M10)
5	(Align OR arrange OR place) AND (button OR coin) AND (battery OR cell OR accumulator)

	Google
1	Button cell electrode
2	Wounded spiral electrode battery
3	Electrode separator roll perpendicular to surface battery
4	Button cell spiral electrode
5	Flat electrode arrangement reduce stress discharging
6	Parallel electrode -insulator placed inside coin cell

7. FIELD OF SEARCH

Following class codes were used alone and/or in combination with other class codes/keywords

IPC/CPC Classification	
H01M2/02	Cases, jackets or wrappings
• H01M2/0222	Button or coin cell cases
• H01M2/0207	Flat-shaped cells or batteries of flat cells (H01M2/0222 takes precedence

• H01M2/0227	with both cup-shaped terminals
• H01M2/0225	with cup-shaped terminals
• H01M2/0202	Cases, jackets or wrappings for small-sized cells or batteries, e.g. miniature battery or power cells, batteries or cells for portable equipment
• H01M2/0287	Cases, jackets or wrappings characterised by the material comprising layers
H01M6/10	Dry cells, i.e. cells wherein the electrolyte is rendered non-fluid with wound or folded electrodes
H01M10/04	Construction or manufacture in general
• H01M10/0427	Button cells
• H01M10/0422	Cells or battery with cylindrical casing
• H01M10/0431	Cells with wound or folded electrodes
• H01M10/0409	For cells with wound electrodes
• H01M10/045	Cells or batteries with folded plate-like electrodes
• H01M10/0463	Cells or batteries with horizontal or inclined electrodes
Y10T29/49108	Electric battery cell making

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